Message

From: Brown, Cheryl A. [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=DD6F8A562924439AAF97CA98DDAF1E10-BROWN, CHERYL]
Sent: 12/20/2018 4:30:26 PM
To: Fullagar, Jill [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=7ba061353c314b40a14a8be1ee382ae3-Gable, Jill]; Labiosa, Rochelle [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=ded3654216c9461d95cd5a3ceec507ef-Labiosa, Rochelle]
Subject: FW: C-CAN News

Important new paper on pteropod damage and effects of thermal stress combined with acidification.
Link below.

Cheryl

Cheryl A. Brown, Ph.D. | Research Oceanographer| U.S. EPA | Office of Research and Development | National Health and Environmental Effects Research Laboratory | Western Ecology Division | 2111 SE Marine Science Center Drive, Newport, Oregon 97365 | 541-867-4042 | brown.cheryl@epa.gov | https://www.researchgate.net/profile/Cheryl_Brown8

From: noreply+feedproxy@google.com <noreply+feedproxy@google.com>
Sent: Wednesday, December 19, 2018 6:05 PM
To: Brown, Cheryl A. <Brown.Cheryl@epa.gov>
Subject: C-CAN News

C-CAN News

Frontiers | El Niño-Related Thermal Stress Coupled With Upwelling-Related Ocean Acidification Negatively Impacts Cellular to Population-Level Responses in Pteropods Along the California Current System With Implications for Increased Bioenergetic Costs | Marine Science

Posted: 19 Dec 2018 09:42 AM PST

Authors: Nina Bednaršek[1*], Richard A. Feely[2], Marcus W. Beck[1], Olivier Glippa[3], Mirella Kanerva[4] and Jonna Engström-Öst[3]

- [1]Southern California Coastal Water Research Project, Costa Mesa, CA, United States
- [2]Pacific Marine Environmental Laboratory, National Oceanic and Atmospheric Administration, Seattle, WA, United States
- [3]Bioeconomy Team, Novia University of Applied Sciences, Ekenäs, Finland
- [4]Laboratory of Environmental Toxicology, Center for Marine Environmental Studies, Ehime University, Matsuyama, Japan

Understanding the interactive effects of multiple stressors on pelagic mollusks associated with global climate change is especially important in highly productive coastal ecosystems of the upwelling regime, such as the California Current System (CCS). Due to temporal overlap between a marine heatwave, an El Niño event, and springtime intensification of the upwelling, pteropods of the CCS were exposed to co-occurring increased temperature, low Ω_{ar} and pH, and deoxygenation. The variability in the natural gradients during NOAA's WCOA 2016 cruise provided a unique opportunity for synoptic study of chemical and biological interactions. We investigated the effects of *in situ* multiple drivers and their interactions across cellular, physiological, and population levels. Oxidative stress biomarkers were used to assess pteropods' cellular status and antioxidant defenses. Low aragonite saturation state (Ω_{ar}) is associated with significant activation of oxidative stress biomarkers, as indicated by increased levels of lipid peroxidation (LPX), but the antioxidative activity defense might be insufficient against cellular stress. Thermal stress in combination with low Ω_{ar} additively increases the level of LPX toxicity, while food availability can mediate the negative effect. On the physiological level, we found synergistic interaction between low Ω_{ar} and deoxygenation and thermal stress (Ω_{ar}:T, O_2:T). On the population level, temperature was the main driver of abundance distribution, with low Ω_{ar} being a strong driver of secondary importance. The additive effects of thermal stress and low Ω_{ar} on abundance suggest a negative effect of El Niño at the population level. Our study clearly demonstrates Ω_{ar} and temperature are master variables in explaining biological responses, cautioning the use of a single parameter in the statistical analyses. High quantities of polyunsaturated fatty acids are susceptible to oxidative stress because of LPX, resulting in the loss of lipid reserves and structural damage to cell membranes, a potential mechanism explaining extreme pteropod sensitivity to low Ω_{ar}. Accumulation of oxidative damage requires metabolic compensation, implying energetic trade-offs under combined thermal and low Ω_{ar} and pH stress. Oxidative stress biomarkers can be used as early-warning signal of multiple stressors on the cellular level, thereby providing important new insights into factors that set limits to species' tolerance to *in situ* multiple drivers.

Full article: https://www.frontiersin.org/articles/10.3389/fmars.2018.00486/full

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